

What is claimed is:

1. A transgenic vertebrate whose genome comprises a bacteriophage RNA polymerase as a transgene, wherein said bacteriophage RNA polymerase transgene is capable of being expressed in at least one cell of said transgenic vertebrate.
2. The transgenic vertebrate of claim 1, wherein said vertebrate is a bird.
3. The transgenic vertebrate of claim 1, wherein said vertebrate is a fish.
4. The transgenic vertebrate of claim 1, wherein said vertebrate is an amphibian.
5. The transgenic vertebrate of claim 1, wherein said vertebrate is a mammal.
6. The transgenic vertebrate of claim 5, wherein said mammal is selected from the group consisting of non-human primates, dogs, cats, sheep, pigs, goats, cattle, horses, ferrets, rats, rabbits, hamsters, gerbils, and mice.
7. The transgenic vertebrate of claim 5, wherein said mammal is a mouse.
8. The transgenic vertebrate of claim 1, wherein said bacteriophage RNA polymerase is selected from the group consisting of T7, SP6, and T3 RNA polymerases.
9. The transgenic vertebrate of claim 1, wherein said bacteriophage RNA polymerase is a T7 RNA polymerase.
10. The transgenic vertebrate of claim 1, wherein said transgene is operably linked to a promoter.
11. The transgenic vertebrate of claim 10, wherein said promoter is a constitutive promoter.
12. The transgenic vertebrate of claim 10, wherein said promoter is an inducible promoter.

13. A method of expressing a protein in a transgenic vertebrate whose genome comprises a bacteriophage RNA polymerase transgene, comprising:

a) providing a construct comprising the following elements operably linked:

- i) a promoter sequence cognate to said bacteriophage RNA polymerase,
- ii) a eukaryotic ribosome recognition sequence, and
- iii) a sequence encoding said protein;

b) introducing said construct into at least one cell of said transgenic vertebrate;
and

c) providing conditions whereby said transgenic vertebrate expresses said protein.

14. The method of claim 13, wherein said transgenic vertebrate is a bird.

15. The method of claim 13, wherein said transgenic vertebrate is a fish.

16. The method of claim 13, wherein said vertebrate is an amphibian.

17. The method of claim 13, wherein said transgenic vertebrate is a mammal.

18. The method of claim 17, wherein said mammal is selected from the group consisting of non-human primates, dogs, cats, sheep, pigs, goats, cattle, horses, ferrets, rats, rabbits, hamsters, gerbils, and mice.

19. The method of claim 17, wherein said mammal is a mouse.

20. The method of claim 13, wherein said bacteriophage RNA polymerase is selected from the group consisting of T7, SP6, and T3 RNA polymerases.

21. The method of claim 13, wherein said bacteriophage RNA polymerase is a T7 RNA polymerase.

22. The method of claim 13, wherein said transgene is operably linked to a promoter.

23. The method of claim 22, wherein said promoter is a constitutive promoter.

24. The method of claim 22, wherein said promoter is an inducible promoter.

25. The method of claim 13, wherein said construct further comprises a stop codon.

26. The method of claim 13, wherein said construct further comprises a tag sequence.

27. The method of claim 13, wherein said construct further comprises a poly-adenosine tail.

5 28. The method of claim 13, further comprising the step of isolating said protein.

29. A protein produced by the method of claim 28.

30. A method to produce at least one antibody against an antigen in a transgenic vertebrate whose genome comprises a bacteriophage RNA polymerase transgene, comprising:

10 a) providing a immunogenic construct comprising the following elements operably linked:

i) a promoter sequence cognate to said bacteriophage RNA polymerase,

ii) a eukaryotic ribosome recognition sequence, and

iii) a sequence encoding said antigen;

15 b) introducing said immunogenic construct into at least one cell of said transgenic vertebrate; and

c) providing conditions whereby said transgenic vertebrate produces said at least one antibody against said antigen.

31. The method of claim 30, wherein said transgenic vertebrate is a bird.

20 32. The method of claim 30, wherein said transgenic vertebrate is a fish.

33. The method of claim 30, wherein said transgenic vertebrate is an amphibian.

34. The method of claim 30, wherein said transgenic vertebrate is a mammal.

35. The method of claim 34, wherein said mammal is selected from the group consisting of non-human primates, dogs, cats, sheep, pigs, goats, cattle, horses, ferrets, rats, rabbits, hamsters, gerbils, and mice.
36. The method of claim 34, wherein said mammal is a mouse.
- 5 37. The method of claim 30, wherein said bacteriophage RNA polymerase is selected from the group consisting of T7, SP6, and T3 RNA polymerases.
38. The method of claim 30, wherein said bacteriophage RNA polymerase is a T7 RNA polymerase.
39. The method of claim 30, wherein said transgene is operably linked to a promoter.
- 10 40. The method of claim 39, wherein said promoter is a constitutive promoter.
41. The method of claim 39, wherein said promoter is an inducible promoter.
42. The method of claim 30, wherein said immunogenic construct further comprises a stop codon.
43. The method of claim 30, wherein said immunogenic construct further comprises a poly-
15 adenosine tail.
44. The method of claim 30, further comprising the step of isolating said at least one antibody as a polyclonal antibody.
45. An antibody produced by the method of claim 44.
46. The method of claim 30, further comprising the steps of collecting spleen cells from said
20 transgenic vertebrate, making at least one hybridoma from said spleen cells, and isolating said at least one antibody as a monoclonal antibody from said at least one hybridoma.
47. An antibody produced by the method of claim 46.
48. The method of claim 30, further comprising the steps of collecting at least one egg from said bird and isolating said at least one antibody as an IgY antibody from yolk of said at
25 least one egg.

49. An antibody produced by the method of claim 48.

50. A method to produce a transgenic vertebrate whose genome comprises a bacteriophage RNA polymerase transgene, comprising:

- a) introducing into the pronucleus of a fertilized ovum of a vertebrate a construct comprising a bacteriophage RNA polymerase as a transgene;
- b) transplanting said ovum into a female of said vertebrate; and
- c) allowing said ovum to develop to term, thereby producing a founder transgenic vertebrate individual.

51. The method of claim 50, wherein said transgenic vertebrate is a bird.

52. The method of claim 50, wherein said transgenic vertebrate is a fish.

53. The method of claim 50, wherein said transgenic vertebrate is an amphibian.

54. The method of claim 50, wherein said transgenic vertebrate is a mammal.

55. The method of claim 55, wherein said mammal is selected from the group consisting of non-human primates, dogs, cats, sheep, pigs, goats, cattle, horses, ferrets, rats, rabbits, hamsters, gerbils, and mice.

56. The method of claim 55, wherein said mammal is a mouse.

57. The method of claim 50, wherein said bacteriophage RNA polymerase is selected from the group consisting of T7, SP6, and T3 RNA polymerases.

58. The method of claim 50, wherein said bacteriophage RNA polymerase is a T7 RNA polymerase.

59. The method of claim 50, wherein said transgene is operably linked to a promoter.

60. The method of claim 59, wherein said promoter is a constitutive promoter.

61. The method of claim 59, wherein said promoter is an inducible promoter.

62. The method of claim 50, further comprising the step of breeding said founder transgenic vertebrate individual to obtain F1 transgenic vertebrates homozygous or hemizygous for said transgene.

63. A method to produce a transgenic vertebrate whose genome comprises a bacteriophage RNA polymerase transgene, comprising:

a) providing a transgene construct comprising a bacteriophage RNA polymerase as a transgene

b) introducing said transgene construct into embryonic stem cells of said vertebrate;

c) selecting at least one embryonic stem cell that has incorporated said transgene by recombination;

d) introducing said at least one embryonic stem cell that has incorporated said transgene by recombination into at least one blastocyst of said vertebrate;

e) transplanting said at least one blastocyst into a pseudopregnant female of said vertebrate; and

f) allowing said at least one blastocyst to develop to term, thereby producing at least one chimeric founder transgenic vertebrate individual.

64. The method of claim 63, wherein said transgenic vertebrate is a bird.

65. The method of claim 63, wherein said transgenic vertebrate is a fish.

66. The method of claim 63, wherein said transgenic vertebrate is an amphibian.

67. The method of claim 63, wherein said transgenic vertebrate is a mammal.

68. The method of claim 67, wherein said mammal is selected from the group consisting of non-human primates, dogs, cats, sheep, pigs, goats, cattle, horses, ferrets, rats, rabbits, hamsters, gerbils, and mice.

69. The method of claim 67, wherein said mammal is a mouse.

70. The method of claim 63, wherein said bacteriophage RNA polymerase is selected from the group consisting of T7, SP6, and T3 RNA polymerases.
71. The method of claim 63, wherein said bacteriophage RNA polymerase is a T7 RNA polymerase.
- 5 72. The method of claim 63, wherein said transgene is operably linked to a promoter.
73. The method of claim 72, wherein said promoter is a constitutive promoter.
74. The method of claim 72, wherein said promoter is an inducible promoter.
75. The method of claim 63, wherein said recombination is homologous.
76. The method of claim 63, wherein said recombination is heterologous.
- 10 77. The method of claim 63, further comprising the step of breeding said chimeric founder transgenic vertebrate individuals to obtain F1 transgenic vertebrates homozygous or hemizygous for said transgene.
78. The method of claim 63, wherein said transgene construct further comprises a viral vector.
- 15 79. The method of claim 63, wherein said viral vector is selected from the group consisting of a lentivirus, a retrovirus, an adenovirus, an adeno-associated virus, a replication-deficient virus, and a hybrid viral vector.

80. A method to produce a transgenic vertebrate whose genome comprises a bacteriophage RNA polymerase transgene, comprising:

a) providing a transgene construct comprising a bacteriophage RNA polymerase as a transgene

b) introducing said transgene construct into at least one embryonic cell of said vertebrate;

c) selecting at least one embryonic cell that has incorporated said transgene by recombination;

d) allowing said at least one embryonic cell that has incorporated said transgene by recombination to develop into at least one blastocyst of said vertebrate;

e) transplanting said at least one blastocyst into a pseudopregnant female of said vertebrate; and

f) allowing said at least one blastocyst to develop to term, thereby producing at least one chimeric founder transgenic vertebrate individual.

81. The method of claim 80, wherein said transgenic vertebrate is a bird.

82. The method of claim 80, wherein said transgenic vertebrate is a fish.

83. The method of claim 80, wherein said transgenic vertebrate is an amphibian.

84. The method of claim 80, wherein said transgenic vertebrate is a mammal.

85. The method of claim 84, wherein said mammal is selected from the group consisting of non-human primates, dogs, cats, sheep, pigs, goats, cattle, horses, ferrets, rats, rabbits, hamsters, gerbils, and mice.

86. The method of claim 84, wherein said mammal is a mouse.

87. The method of claim 80, wherein said bacteriophage RNA polymerase is selected from the group consisting of T7, SP6, and T3 RNA polymerases.

88. The method of claim 80, wherein said bacteriophage RNA polymerase is a T7 RNA polymerase.

89. The method of claim 80, wherein said transgene is operably linked to a promoter.

90. The method of claim 89, wherein said promoter is a constitutive promoter.

5 91. The method of claim 89, wherein said promoter is an inducible promoter.

92. The method of claim 80, wherein said recombination is homologous.

93. The method of claim 80, wherein said recombination is heterologous.

94. The method of claim 80, further comprising the step of breeding said chimeric founder transgenic vertebrate individuals to obtain F1 transgenic vertebrates homozygous or hemizygous for said transgene.

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95. The method of claim 80, wherein said transgene construct further comprises a viral vector.

96. The method of claim 95, wherein said viral vector is selected from the group consisting of a lentivirus, a retrovirus, an adenovirus, an adeno-associated virus, a replication-deficient virus, and a hybrid viral vector.

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97. The method of claim 80, wherein said at least one embryonic cell is at least one morula cell.

98. A method to produce a transgenic vertebrate whose genome comprises a bacteriophage RNA polymerase transgene, comprising:

a) providing a transgene construct comprising a bacteriophage RNA polymerase as a transgene

b) introducing said transgene construct into at least one male germ-line stem cell of said vertebrate;

c) selecting said at least one male germ-line stem cell that has incorporated said transgene by recombination;

d) introducing said at least one male germ-line stem cell that has incorporated said transgene by recombination into a recipient male of said vertebrate;

e) allowing said at least one male germ-line stem cell that has incorporated said transgene by recombination to develop to maturity in said recipient male, thereby producing at least one mature transgenic spermatozoon; and

f) breeding said recipient male carrying said at least one mature transgenic spermatozoon to obtain F1 transgenic vertebrates hemizygous for said transgene.

99. The method of claim 98, wherein said transgenic vertebrate is a bird.

100. The method of claim 98, wherein said transgenic vertebrate is a fish.

101. The method of claim 98, wherein said transgenic vertebrate is an amphibian.

102. The method of claim 98, wherein said transgenic vertebrate is a mammal.

103. The method of claim 102, wherein said mammal is selected from the group consisting of non-human primates, dogs, cats, sheep, pigs, goats, cattle, horses, ferrets, rats, rabbits, hamsters, gerbils, and mice.

104. The method of claim 102, wherein said mammal is a mouse.

105. The method of claim 98, wherein said bacteriophage RNA polymerase is selected from the group consisting of T7, SP6, and T3 RNA polymerases.
106. The method of claim 98, wherein said bacteriophage RNA polymerase is a T7 RNA polymerase.
- 5 107. The method of claim 98, wherein said transgene is operably linked to a promoter.
108. The method of claim 107, wherein said promoter is a constitutive promoter.
109. The method of claim 107, wherein said promoter is an inducible promoter.
110. The method of claim 98, wherein said recombination is homologous.
111. The method of claim 98, wherein said recombination is heterologous.
- 10 112. The method of claim 98, wherein said transgene construct further comprises a viral vector.
113. The method of claim 112, wherein said viral vector is selected from the group consisting of a lentivirus, a retrovirus, an adenovirus, an adeno-associated virus, a replication-deficient virus, and a hybrid viral vector.